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(54) IMPROVEMENTS IN AND RELATING TO SPLICING WEBS OF SHEET MATERIAL

(71) We, STANLEY GUSTAFSON, a citizen of the United States of America, of 22, Alpine Close, Croydon, CR0 5UN, England, and ANTHONY JOHN SISSONS, a British subject of 22 Alpine Close, Croydon, CR0 5UN, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to splicing webs of sheet material and has particular, but not exclusive, application to splicing paper webs, especially for use in the manufacture of corrugated paper.

At the present time the paper feed into corrugating machinery is from reels of, for example 2 to 3 tons weight and in order to maintain continuity of feed two special arrangements have been devised to splice the end of an exhausting reel to the start of a replacement reel. In one commonly adopted arrangement (the so-called "flying splice"), the peripheral speed of a replacement reel is brought up to the speed of the paper being fed from the exhausting reel and the splice effected when the said speeds are substantially equal. In the other commonly adopted arrangement (the so-called stationary splice), the inlet path followed by the paper feed is variable in length so that paper at commencement of said path can be momentarily reduced to a stationary state without varying the speed of paper at the termination of the path. Usually, said path is of a zig-zag configuration with the apices defined by idler rollers arranged in two relatively movable sets to vary the length of the inter-apices sections of the path.

Neither of the said arrangements is satisfactory in that it involves costly equipment and/or requires substantial operator skill to ensure a good splice.

The present invention aims to provide a relatively inexpensive arrangement suitable for splicing paper for feeding to corrugating machinery which is operable reliably by relatively unskilled operatives.

According to the present invention, there is provided a method of splicing a replacement web of sheet material to a moving existing web of sheet material which comprises providing on a portion of a face of the replacement web adhesive means for adhering said webs together, aligning said portion in opposed relationship with the moving web at a position along the path thereof, bringing the said webs into frictional engagement so that the moving web drives the replacement web and pressing the said webs together downstream of said position to sandwich the adhesive means between the webs.

The method of the invention has particular use in splicing together webs of paper, especially for use in corrugating machinery, where the replacement web is stored on a replacement reel and the moving web is being drawn from an exhausting reel. In the corrugating application the replacement reel weighs as much as 3 tons and it has previously been assumed that a splice could not be made between a moving web portion and a stationary web end from the replacement reel. The present invention permits such a splice to be readily made with the moving web travelling at a speed of up to 35 to 40 meters per minute. If desired or in some cases necessary, the stationary reel can be given an initial spin simultaneously with the frictional engagement of the webs to overcome or at least reduce the inertia of the reel to rotation in response to movement of the web thereof. Other means of reducing the strain upon the stationary web upon commencement of movement thereof can alternatively or additionally be provided. For example, a

path of variable length can be provided in similar manner to that used in stationary splicing as described above.

The method can be used to under or over splice as required and when consecutive splicing operations are carried out under splicing can alternate with over splicing.

It is preferred that cutting means are operated simultaneously with frictional engagement of the webs to sever the moving web upstream of the position of such engagement.

Suitably, the webs are frictionally engaged by pressing them together in the nip between two relatively movable rollers. The means moving said rollers can also serve to operate the cutting means if present. The means pressing the webs together to sandwich the adhesive means between them can also comprise the nip between a further pair of rollers. It is presently preferred that the adhesive means is double sided adhesive tape, which tape is known for use in conventional flying and stationary splicing.

The invention also provides apparatus for carrying out the method of the present invention, which apparatus comprises locating means for aligning the end portion of the replacement web in opposed relationship to the moving web at a position along the path thereof, at which position adhesive can be applied to the said end portion of the replacement web, drive means in the form of a first pair of rollers for bringing the webs of sheet material into frictional engagement by passing the webs through the nip between the rollers so that the moving web drives the previously stationary replacement web and pressure means in the form of a second pair of rollers located downstream of said position to sandwich the adhesive between the webs by passing the webs through the nip between said second pair of rollers.

Preferably, cutting means are provided to sever the moving web and said means is desirably located upstream of the drive means.

The locating means in the case of apparatus adapted for oversplicing can comprise a stationary guideplate preventing upward movement of the replacement web during splicing. In the case of apparatus adapted for undersplicing, said means can include a support plate for supporting the replacement web below the moving web. Suitably, said plate is pivotally mounted for movement to an inoperative attitude to facilitate for example cutting of the replacement web to a desired length and/or location of the adhesive means on said web.

The splicing apparatus and method is of relatively simple and inexpensive construction so as to avoid the use of highly skilled maintenance personnel. It is relatively compact and may be readily incorporated in existing paper sheet corrugating installations without requiring expensive modifications or additional equipment. The apparatus can be pneumatically operated by standard factory compressed air supply and only two manually operable push button type electrical controls need be utilized, one for slow-down of the corrugator apparatus and the other for initiating operation of the splicer apparatus. The actual operation of the apparatus is fully pneumatic without use of electric motors and electronic control circuits. Thus, the splicer apparatus is easy to operate and does not require a highly skilled operator. The splice preparation procedure is relatively simple and straight line threading is employed to reduce preparation time. The splicing apparatus may be operated automatically or remotely at a central control station. The apparatus has the additional advantages of enabling consistent good splices with minimum waste. The length of the tail on the depleting roll may consistently be kept at a length of from 8 to 10 inches so as to enable each paper roll to be substantially completely utilized. The apparatus requires minimal maintenance involving only lubrication and cleaning. In addition, the cutting means may consist of a knife blade assembly comprising a series of individual blades designed for maximum cutting efficiency and easy individual blade replacement.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of a paper web infeed to a corrugating machine which infeed incorporates apparatus in accordance with the present invention and is shown in its normal running conditions;

Figure 2 is a diagrammatic view corresponding to that of Figure 1 and showing a replacement web under preparation for splicing to the moving web;

Figure 3 is a diagrammatic view corresponding to that of Figure 2 and showing the replacement web at commencement of the splicing attitude;

Figure 4 is a diagrammatic view corresponding to that of Figure 3 and showing the webs at an intermediate time in the splicing operation;

Figure 5 is a diagrammatic view corresponding to that of Figure 4 and showing the webs at termination of the splicing operation;

Figure 6 is an end elevational view of a presently preferred embodiment of the apparatus of Figures 1-5;

Figure 7 is a side elevational view of the apparatus of Figure 6 taken in the direction

Figure 17 is a detailed section through a second embodiment of a splicing apparatus according to the invention; and

Figure 18 is a perspective view, to an enlarged scale, of the transporter bar forming part of the apparatus illustrated in Figure 17.

In the drawings, like parts are denoted by like reference numerals.

Reference will first be made to Figures 1 to 5 of the drawings in which splicing apparatus in accordance with an embodiment of the invention comprises a pair of idler rollers 1.2 defining between them a web-receiving nip. Upstream of said rollers 1,2 are located rollers 3,4 of which roller 4 is movable vertically by a pneumatic cylinder 5 while the axis of roller 3 is fixed. Conveniently rollers 1,2 and 3 are made of steel and roller 4 is made of rubber or is rubber-faced. A guide bar 6 and pivoted cutting knife 7 are disposed sequentially upstream of roller 3. Knife 7 is arranged to operate at a predetermined time after raising of roller 4 into its uppermost position. A guide plate 8 is mounted for pivotal movement about the axis of roller 4 between a vertical attitude (as shown in Figures 1 and 2) and a horizontal attitude (as shown in Figures 3,4 and 5).

In normal operation (shown in Figure 1) a web of paper 9 from an exhausting reel (not shown) mounted on a rotatable mill roll stand (also not shown) is fed under bar 6 and roller 3 to pass between rollers 1,2 to be drawn into a corrugating machine (not shown). The mill roll stand carries a replacement reel 10 which is mounted on the stand whilst the web from the exhausting reel is being drawn into the machine. The leading end of the web 11 on reel 10 is passed over roller 4 to be against guide plate 8 and is cut to a desired length indicated by a mark on said plate. Means (not shown) are provided to prevent web 11 from falling off the roller 4. For example retention rollers can be provided upstream of roller 4. Double sided adhesive tape 12 is then connected to the face of the end of the web 11 remote from guide plate 8. This condition is shown in Figure 2.

The guide plate 8 is pivoted to its horizontal position as shown in Figure 3 whence the end of web 11 is located in spaced parallel relationship to moving web 9. When a splice is to be made, roller 4 is raised causing webs 9 and 11 to frictionally engage whereby web 9 drives web 11 forwardly along the plate 8. The condition at commencement of said engagement is shown in Figure 4.

The forward movement of the webs 9,11 causes them to pass together through the nip between rollers 1 and 2 thereby sandwiching the tape 12 between the webs to effect the splice. Simultaneously or shortly thereafter, knife 7 is pivoted to sever web 9 leaving web 11 to supply the corrugating machine. The mill roll stand is then rotated to bring reel 10 to the position previously occupied by the exhausting reel whereby said exhausting reel can be removed and replaced by a fresh reel which then occupies the position of reel 10 shown in the Figures.

Referring now to Figs. 6-12, a presently preferred embodiment of the apparatus of Figs. 1-5 is shown to comprise a pair of opposite end plate support members 20, 22 connected by two elongated support beam members 24, 26 adapted to be fixedly mounted on overhead support means (not shown) by four vertical support beam members only three of which 28, 30 and 34 are shown.

Rollers 1, 2, 3 and 4 are mounted on end plate members 20, 22 and extend therebetween. The rollers have equal diameters and the axes of rotation 36, 38 of rollers 3, 4 and the axes of rotation 40, 42 of rollers 1, 2 are vertically aligned in the operative positions shown in Fig. 8. However, the axes 40, 42 of rollers 1, 2 are vertically upwardly offset relative to the axes 36, 38 of rollers 3, 4 as indicated at 44, 46 for a purpose to be hereinafter described. The horizontal distance between axes 36, 38 and axes 40, 42 is only approximately 14 inches to provide a relatively short length splicing cavity 47 there-between. A cylindrical guide tube member 48 extends between end plates 20, 22 and has a web holding means 49 mounted at each end thereof.

Rollers 1 and 3 are rotatably supported by bearing plate means 50, 52 fixedly mounted on end plate members 20, 22 whereas rollers 2, 4 are rotatably mounted on bearing plate means 54, 56 pivotally mounted on the end plate members 20, 22 for pivotal movement about pivot axes 58, 59 between an inward operating position in juxtaposition to corresponding rollers 1, 3, as shown in Fig. 8, and an outward non-operating position in outwardly spaced relationship to the corresponding rollers 1, 3, not shown. Air operated cylinders 60, 62 mounted on end plate member 22 are operably connected by suitable linkage means 64, 66 to bearing plate means 54, 56 for selectively causing pivotal movement of rollers 2, 4, and stop block means 68, 70 may be provided on end plate members 20, 22 to limit outward movement.

The guide plate means 8 comprises an elongated table member 72 of rectangular cross-section, which may be made of relatively lightweight material such as wood, supportively mounted in a table frame means 74 fixed at each end by a bracket 75 to pivotal link means 76 pivotally

mounted on the side plates 20, 22 for pivotal movement about pivotal axis 78 from an outward loading position, Fig. 8, and an inwardly displaced splicing position (not shown). A stop rod means 80 and a stop block means 82 mounted on each of the side plate members 20, 22 are engageable, respectively, with link means 76 in the loading position and with a stop block means 84, mounted on each end of the frame means 74, in the splicing position. A pair of suitably spaced and positioned handle members 86 are mounted on the back surface 88 of the table member to enable manual positioning thereof and suitable latch means 89 in the form of a spring loaded ball detent member (Fig. 11) are provided to releasably engage a slot 90, Fig. 8, in the side plates and hold the table member in the splicing position. An elongated groove 91 extends from end to end of the front working surface 92 of the table member 72.

The cutting knife means 7 comprises an elongated rotatable knife bar member 100, of square cross-sectional configuration, having knife blade means 101 fixedly attached along one side surface 102 thereof. The knife bar member 100 extends between end plates 20, 22 and is fixedly mounted on rotatable end shaft means 103 rotatably supported by the end plates to provide an axis of rotation 104 which is eccentric to the central axis 106 of the knife bar member 100. Knife bar operating means (Fig. 10) in the form of an air cylinder 110 operably connected to a length of chain 112 fixed to a reduced diameter portion of the shaft means 103 at 114 and a tension spring member 116 connected at one end 118 to the frame member 24 and at the other end 120 to a length of chain 122 fixed to the shaft means at 114, are provided to rotate the shaft means 103 about axis 104 and move the knife bar member 100 and knife blade means 101 between an outward inoperative position, Fig. 9, and an inward cutting position, Fig. 8. A stop means, in the form of a bracket arm member 124 mounted on side surface 126 of bar member 100 and carrying a stop block member 127, engageable with the guide bar means 6, in the form of an elongated tube member 128 extending between end plates 20, 22 is provided to locate the knife bar member 100 and knife means 101 in the operative cutting position, Fig. 8.

As shown in Figs. 8 and 12, a presently preferred form of knife means 101 comprises a plurality of individual knife members 129 of generally rectangular peripheral and cross-sectional configuration with pointed tapered inclined outer cutting surface means 130. Each knife member comprises relative wide parallel front and back side surfaces 132, 134, Fig. 8, with back side surface 134 being mounted in abutting supportive engagement with knife bar side surface 102 by suitable fastening means 136. Relatively narrow width parallel side edge surfaces 138, 140, Fig. 12, are adapted to be mounted in close fitting abutting engagement with the side edge surfaces of next adjacent knife members. The cutting surface means 130 of each knife member comprises a flat surface 142, Fig. 8, which is tapered and inclined relative to side surfaces 132, 134, so as to extend outwardly and forwardly relative to the direction of movement of the moving web, and which is tapered and inclined relative to side surfaces 138, 140, Fig. 11, so as to terminate at one end in an outermost sharp penetrating point 144 and to terminate at the other end at an innermost location 146 defining an inclined sharp slicing edge 148 extending along a slicing gap 150 between adjacent penetrating points 144 of adjacent knife members. The aforedescribed knife construction and arrangement is particularly useful for cutting relatively heavy paper without tearing as has been a problem with prior art devices.

While the foregoing knife construction provides exceptionally good results for most kinds and weights of sheet materials, relatively heavy weight sheet materials, such as kraft liner board, are better cut by a blade of the design of Figs. 13 to 16, which comprises a blade member 200 having a mounting hole 202, front and rear surfaces 204, 206, parallel side surfaces 208, 210, a piercing point 212 and a cutting edge 214 which is inclined relative to side wall surfaces 208, 210 at an included angle of approximately 55° as indicated at 215 shown in Fig. 14.

The cutting edge 214 comprises a first innermost portion 216 and a second outermost portion 218 which intersect at 220. Cutting edge portion 216 is defined by the intersection of a first flat inclined surface 222 of quadrilateral configuration which intersects and extends between front and back surfaces 204, 206 at an included angle of approximately 30° as indicated at 223 in Fig. 15. Cutting edge portion 218 is defined by the intersection of a second flat inclined surface 224 of triangular configuration, which interescts and extends between front and back surfaces 204, 206 at an included angle of approximately 30° to provide a triangular shape tip surface portion on the outer end of side surface 210 as indicated at 225, Fig. 15, and a third flat inclined surface 226 of triangular configuration which intersects side surface 210 at an included angle of approximately 30° as indicated at 227, Fig. 13, to define a triangular shape tip surface portion 228 at

the outer end of front surface 204. of arrow 7 of Figure 6;

Figure 8 is a partial cross-sectional end elevational view of the apparatus of Figures 6 and 7 taken along the line 8-8 in Figure 7;

Figure 9 is a partial cross-sectional end elevational view of the apparatus of Figures 6 and 7 taken along line 9-9 in Figure 7;

Figure 10 is a partial cross-sectional end elevational view taken along line 10-10 in Figure 7;

Figure 11 is a partial end view of a portion of the apparatus of Fig. 8 taken in the direction of the arrow 11 in Fig. 8;

Figure 12 is an enlarged partial side elevational view of the knife means of Figure 8;

Figure 13 is a rear side elevational view of an alternative form of a knife member;

Figure 14 is a front side elevational view of the knife member of Figure 13;

Figure 15 is a side elevational view of the knife member of Figures 13 and 14;

Figure 16 is a bottom view of the knife member of Figures 13-15;

The piercing point 212 is defined by the intersections of the four triangular shape flat outer surfaces 224, 225, 226, 227 to provide a truncated (pyramidal) piercing means for piercing the sheet material, establishing an initial direction of cutting along a first cutting edge portion 218, and then changing the direction of cutting along a second cutting edge portion 216 whereby to overcome the resistance of relatively heavy high strength sheet material to the cutting action. It is to be noted that the blade design of Figs. 8 and 12 is specifically different than the blade design of Figs. 13-16 in that the cutting edge 130 of the blade design of Figs. 8 and 12 is on the front surface 132 (i.e. the surface facing the direction of travel of the web) whereas the cutting edge 214 of Figs. 13-16 is on the back surface 206 (i.e. the surface facing opposite to the direction of travel of the web).

In operation of the apparatus of Figs. 6-16, during normal unwinding of the web 9 prior to a splicing operation, the knife means 7 is located in the outward upwardly displaced inoperative position of Fig. 9, by the spring means 116 (Fig. 10); the roller 4 is located in the outward downwardly displaced position as generally illustrated in Figs. 1 to 3 with plate 54 supported on abutment block 68; the roller 2 is located in the outward downwardly displaced position as generally illustrated in Figs. 1 to 3 with plate 56 supported on abutment block 70; and the table means 8 is located in the outward downwardly displaced position of Fig. 8.

It is noted that in the event of power failure or loss of air pressure, the knife means 7 will be returned to and positively held in the inoperative position by the spring means 116, and the rollers 2, 4 will be returned to and positively held in the inoperative positions by gravity. Thus, an important advantage of this arrangement is that each part of the apparatus operable during a splicing operation is normally positively located in the inoperative position whereby to preclude accidental movement toward the operative positions upon any system failures such as loss of air pressure and overcome safety problems of certain prior art arrangements. During normal unwinding, the web 9 extends downwardly from the roll of material as generally illustrated in Figs. 1 to 4 and 8 at a suitable angle of, for example, approximately 30° toward and engages the bottom surface of guide tube 128; across the splicer cavity 47 in upwardly spaced relationship to the upper surface of roller 4 as generally shown in Figs. 1 to 3; engages the upper surface of roller 2 in downwardly spaced relationship to roller 1; and extends downwardly from roller 2 in the direction of the arrow 230 (Fig. 8).

In order to prepare for the splicing operation, the lead edge of a new roll of web material 11 is pulled over the upper surfaces of guide tube 48 and roller 4 beneath and in downwardly spaced relationship to the moving web 9 as generally illustrated in Fig. 1. The lead edge is pulled downwardly along table surface 92 beyond cutting groove 91 and then trimmed to leave a straight lead edge 232 extending along the groove 91. A strip of double backed adhesive tape material 234 is secured along the lead edge 232. The side edges of the sheet of the new roll are aligned with the side edges of the web 9 of the old roll and engaged with the spring loaded holder devices 49 (Fig. 8) on guide tube 48 to maintain the alignment. Then, the table means 8 is moved upwardly to and latched in the splicing position as illustrated in Figs. 4 and 8, with stop block means 84 at each end engaging stop block means 82 to locate the upper surface 236 of the lead portion of the new roll 10 supported on table surface 92 and the upper adhesive surface 238 of the splicing tape in relatively closely spaced proximity to the lower surface 240 of the adjacent portion 242 of the moving web 9. The arrangement of table surface 92, link 76, and pivotal axis 78 is such that the lead edge 232 of the new material and the adhesive strip 238 move outwardly in the direction of arrow 244 (Fig. 8) along surface 92 toward the outer edge 246 of the table 72 so that, in the splicing position, the lead edge 232 and adhesive tape 234 are located in relatively

close proximity to the surface 248 of roller 2.

Just before the splicing operation is initiated, the speed of movement of the web 9 is reduced to a relatively slow splicing speed by actuation of a control button 250, Fig. 6, which actuates conventional speed control apparatus (not shown). In order to initiate the splicing operation, the operator actuates a control button 252, Fig. 6, whereupon compressed air is delivered to air cylinder 62 at a relatively fast rate resulting in rapid upward pivotal movement of roller 2 a relatively short distance, as indicated by the spacing between plate 56 and stop 70 in Fig. 8, to the position of engagement with roller 1 with the web 9 on roller 2 being upwardly displaced to provide guide means which establish an upwardly inclined path of movement of the web 9 from the guide tube 128 and roller 3 to the rollers 1, 2 which are caused to rotate by frictional engagement under pressure with the moving web 9. Compressed air is also delivered to air cylinder 60 at a relatively slow rate causing the roller 4 to be somewhat more slowly pivotally upwardly displaced a relatively long distance, as indicated by the spacing between plate 54 and stop 68, to the position of engagement with roller 3 a relatively short time, e.g. one second or less, subsequent to engagement of roller 2 with roller 1. The upward movement of roller 4 causes upward movement of the portion of the replacement web 11 supported thereon and engagement of the upper surface of the replacement web 11 portion with the lower surface of the relatively slowly moving web 9. In this manner, movement of the replacement web 11 is initiated by frictional contact with the moving web 9 maintained by the pressure of the rollers 3, 4 and supplemented by the rotation of rollers 3, 4 caused by frictional engagement under pressure with the webs 9 and 11. The movement of the replacement web 11 results in forward movement of the lead edge 232 onto the upper portion 248 of the surface of the rotating lower roller 2 and upward movement toward the lower surface 240 of the web 9 and the lower surface of upper roller 1 to cause the upper adhesive surface 238 of the splicing tape 234 to engage the lower surface 240 of the web 9 just prior to passage between rollers 1, 2 whereat the pressure of the rollers firmly adhesively connects the replacement web 11 to the moving web 9.

Shortly after the adhesive connection has been effected, compressed air is delivered to knife operating air cylinder 110 (Fig. 10) through suitable time delay means (not shown) to pull chains 112, 122 against the bias of spring means 116 and cause rapid rotation of shaft portions 103, knife bar 100, and knives 101 or 200 from the retracted position to the cutting position. The construction and arrangement of the knives is such that the piercing points 144 or 212 make initial contact with the upper surface of the web 9 at a rearwardly downwardly inclined angle during the movement of the knives from the retracted position to the final cutting position whereat stop 127 engages tube 128. In addition, as the movement of the knives continues after the initial contact, the included angle between the side surfaces 132 or 204 of the knives and the plane of the web 9 gradually increases as the point of contact between the inclined cutting edges 148 or 214 of the knives and the web 9 moves laterally away from the piercing points 144 or 212 toward the short side surfaces 138 or 208. The result is that a relatively clear sharp straight cut is made across the web 9 without discontinuous ripping, tearing and unravelling of the web as caused by prior art devices. In a presently preferred embodiment, the knives 101 or 200 are mounted on the knife bar in slightly staggered offset relationship, as indicated by line 250, 252, Fig. 12, so that the piercing point 144 or 212 of the centermost knife, indicated at 136, is located furthest outwardly relative to the piercing points of the other knives and contacts the centre portion of the web before the other knives with subsequent contact with the piercing points of the other knives proceeding sequentially outwardly toward both side edges of the web 9.

After a relatively short time sufficient to enable the cutting knives to reach the full outward cutting position, the effective application of pressurized air to all the air cylinders is automatically terminated whereupon the spring means 116 is immediately effective to return the knife means 7 to the retracted position and the weight of rollers 2, 4 is effective to return them to their downwardly displaced positions. The operator may then manually return the table means 8 to the downwardly displaced loading position.

In the embodiment illustrated in Figures 17 and 18 of the drawings, a replacement web may be spliced to a moving web either from above (over-splicing) or below (under-splicing) the moving web. In this case, the splicer 21 is provided with two cutting knives (not shown). When the moving web 9 is coming from the left hand roll shown in Figure 17, it is necessary to effect an oversplice of the web wound on the right hand roll 10. The leading end 11 of this roll is drawn over a transporter bar 41 and is prepared on the guide plate 8 which is pivotally mounted on the transporter bar. The leading end of the replacement web 11

is retained on the transporter bar 41 by means of a gripper roller 42 which is pivotally mounted on the bar between a first position permitting the web to pass freely between the bar 41 and roller 42 and a second position in which the roller is urged in a direction towards the bar to grip the web therebetween. The leading edge of the transporter bar 41, i.e. the edge remote from the guide plate 8, is provided with a series of pins or spines 43 designed to support the leading end of the replacement web. If desired, these pins or spines may be replaced or supplemented by a series of plates made, for example, of resilient plastics material.

The transporter bar 41 is mounted in guide channels 44 and is arranged to be driven by suitable means, such as a chain (not shown) along the channels 44 from the position shown in Figure 7 to the splicer 21. The entrapped web 11 is moved with the transporter bar 41 so that its leading end is located ready for splicing. The splicer itself is similar to the embodiment shown in Figure 6 except that a further knife is provided for severing the lower web when required. In this case, when splicing is to be effected, the gripping roller 42 is moved to release the web 11 and the transporter bar is retracted along the guide channel 44 so that the web 11 is released to fall onto the moving web. The two webs are spliced together by the splicer 21 and the said further knife is operated to sever the lower web. The exhausting roll can then be replaced by a fresh roll and, in due course, spliced to the roll 10 by undersplicing in the manner above described. In the meantime, the transporter bar 41 is returned to the position shown in Figure 7 to be ready for a further splicing operation.

It will be appreciated that the invention is not restricted to the details described above but that numerous modifications and variations can be made without departing from the scope of the invention.

WHAT WE CLAIM IS:—

1. A method of splicing a replacement web of sheet material to a moving existing web of sheet material which comprises providing on a portion of a face of the replacement web adhesive means for adhering said webs together, aligning said portion in opposed relationship with the moving web at a position along the path thereof, bringing the said webs into frictional engagement so that the moving web drives the replacement web and pressing the said webs together downstream of said position to sandwich the adhesive means between the webs.

2. A method according to claim 1, wherein the moving web is wound onto a first roll and wherein the replacement web is wound onto a second roll when the web on said roll is to be spliced to the moving web.

3. A method according to claim 2, wherein an initial spin is imparted to the second roll.

4. A method according to claim 2 or claim 3, wherein the moving web of sheet material is severed upstream of the position of frictional engagement.

5. A method according to any one of claims 2 to 4, wherein the webs of sheet material are frictionally engaged by pressing them together in the nip between two relatively movable rollers.

6. A method according to any one of claims 2 to 5, wherein the means pressing the materials together to sandwich the adhesive means between them comprise the nip between two rollers.

7. A method according to any one of claims 2 to 6, wherein the replacement web is fed to the moving web underneath said moving web whereby the resulting splice is an undersplice.

8. A method according to any one of claims 2 to 6, wherein means are provided for leading a replacement web to the moving web alternately above and below said moving web whereby the resulting splices are alternately oversplices and undersplices.

9. A method according to any preceding claim, wherein the adhesive means comprises a double sided adhesive tape.

10. Apparatus for splicing a replacement web of sheet material to a moving web of sheet material, said apparatus comprising locating means for aligning the end portion of the replacement web in opposed relationship to the moving web at a position along the path thereof, at which position adhesive can be applied to the said end portion of the replacement web, drive means in the form of a first pair of rollers for bringing the webs of sheet material into frictional engagement by passing the webs through the nip between the rollers so that the moving web drives the previously stationary replacement web and pressure means in the form of a second pair of rollers located downstream of said position to sandwich the adhesive between the webs by passing the webs through the nip between said second pair of rollers.

11. Apparatus according to claim 10, wherein cutting means are provided to sever the moving web.

12. Apparatus according to claim 11, wherein the cutting means is located upstream of the drive means.

13. Apparatus according to claim 11 or claim 12, wherein the cutting means comprise an elongated knife supporting bar member, elongated knife mounting surface

means on said bar member, knife mounting means associated with said bar member for mounting a plurality of individual members on said knife mounting surface means; a plurality of individual knife members mounted in side by side relationship on said knife mounting surface means for piercing and cutting the moving sheet during movement of said bar member from the inoperative position to the cutting position; and bar member operating means for causing movement of said bar member between the inoperative position and the cutting position.

14. Apparatus according to claim 13, wherein said bar member operating means comprises air cylinder means operatively connected to said bar member for moving said bar member from the inoperative position to the cutting position and spring means operatively associated with said bar member for moving said bar member from the operative position to the inoperative position.

15. Apparatus according to claim 13 or claim 14, wherein said mounting means comprises shaft means for providing an axis of rotation for said bar member and wherein said mounting surface means has an axis of rotation eccentrically located relative to said axis of rotation of said shaft means.

16. Apparatus according to any one of claims 13 to 15, wherein each of said knife members comprises front and rear spaced parallel surfaces, a short length side surface and a long length side surface extending between and connecting said front and rear spaced parallel surfaces, a cutting edge extending between and being inclined relative to said short length side surface and said long length side surface, a piercing point at the intersection of said cutting edge and said long length side surface, the short length side surface of each knife member except the one at one end of the cutting means abutting the long side surface of the next adjacent knife member, and the long length side surface of each knife member except the one at the other end of the cutting means abutting the short side surface of the next adjacent knife member.

17. Apparatus according to any one of claims 10 to 16, and including a support plate for supporting the replacement web below the moving web.

18. Apparatus according to claim 17, wherein the support plate is pivotally mounted for movement to an inoperative position to facilitate application of adhesive to the end portion of the replacement web.

19. Apparatus according to any one of claims 10 to 16, wherein a guide plate is provided for supporting the replacement web above the moving web.

20. Apparatus according to claim 19, wherein the guide plate is provided with a gripping roller for retaining the end portion of the replacement web on the guide plate.

21. Apparatus according to claim 19 or claim 20, wherein the guide plate is mounted for movement along a guide channel between a first position in which adhesive is applied to the end portion of the replacement web and a second position in which the end portion of the replacement web is aligned with the moving web.

22. Apparatus according to any one of claims 19 to 21, wherein the guide plate is provided with a series of pins or spines for supporting the end portion of the replacement web.

23. A method of splicing a replacement web of sheet material to a moving web of sheet material substantially as described herein with reference to the accompanying drawings.

24. Apparatus for splicing a replacement web of sheet material to a moving web of sheet material substantially as described herein with reference to the accompanying drawings.

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1569886 COMPLETE SPECIFICATION

7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 1.

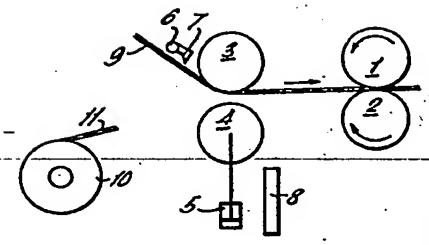


FIG. 2.

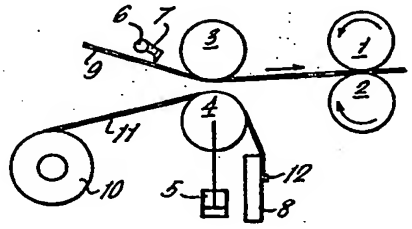


FIG. 3.

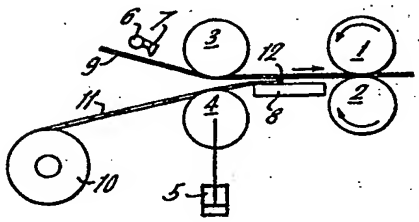


FIG. 4.

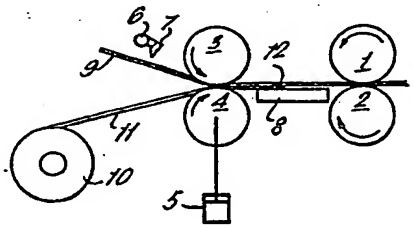
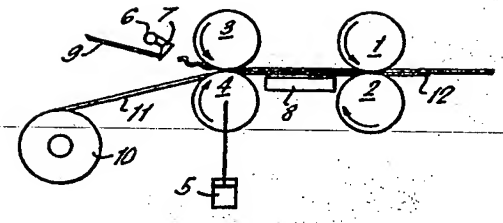


FIG. 5.



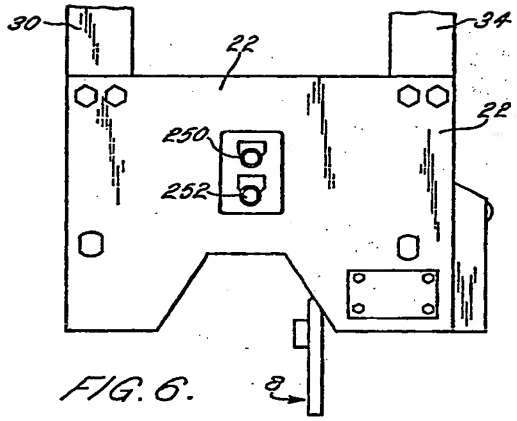


FIG. 6.

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7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
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FIG. 7.

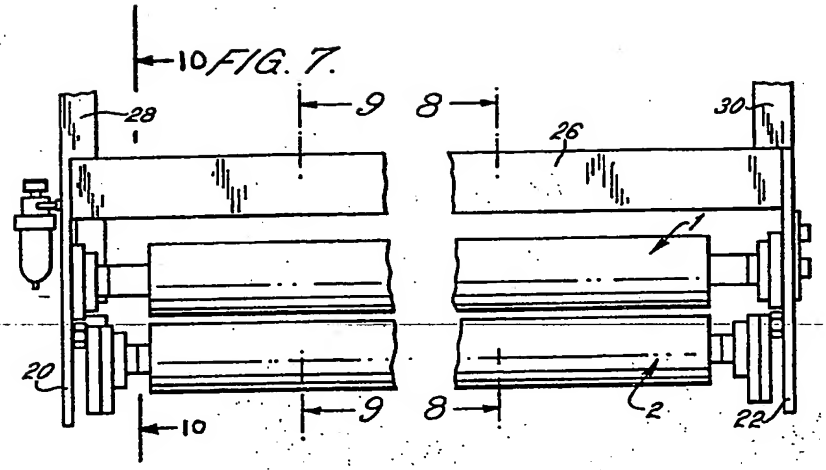

FIG. 9.

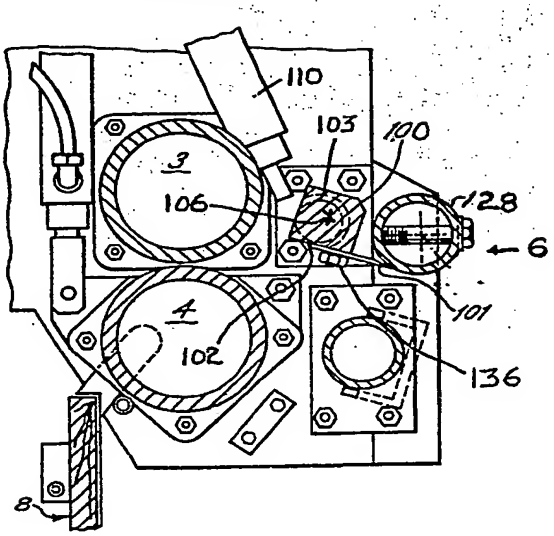

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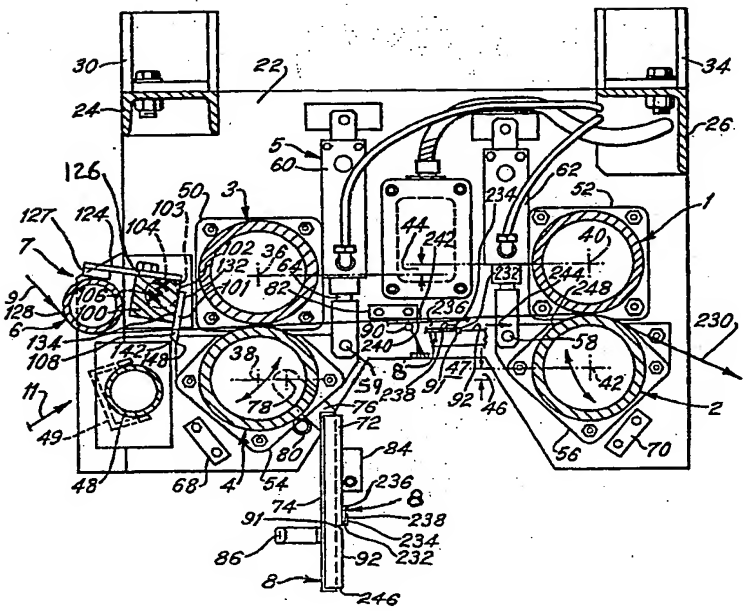
FIG. 8.



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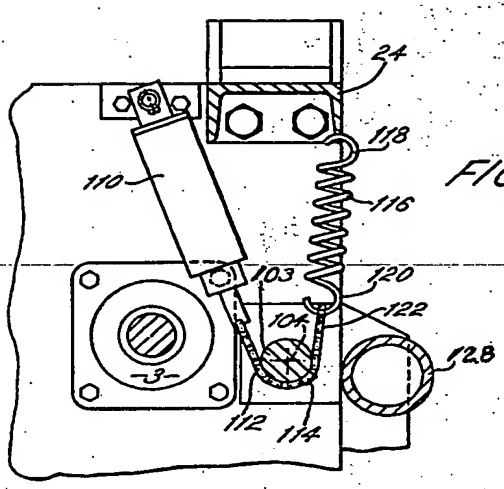

FIG. 10.

FIG. 11.

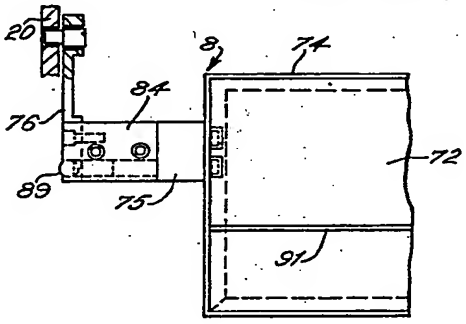

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FIG. 12.

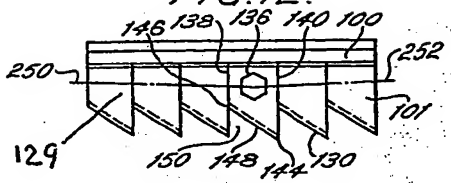


FIG. 13.

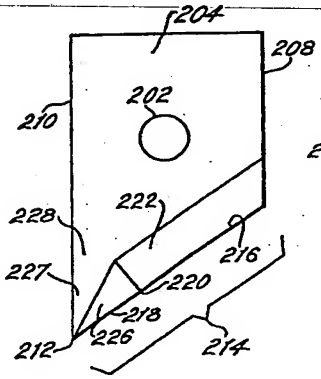
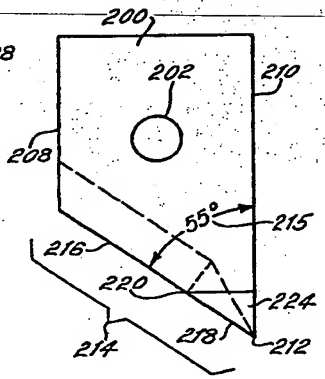


FIG. 14.



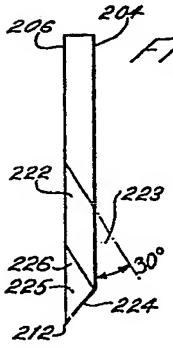


FIG. 15.

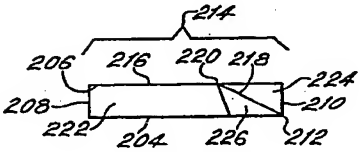


FIG. 16.

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FIG. 17.

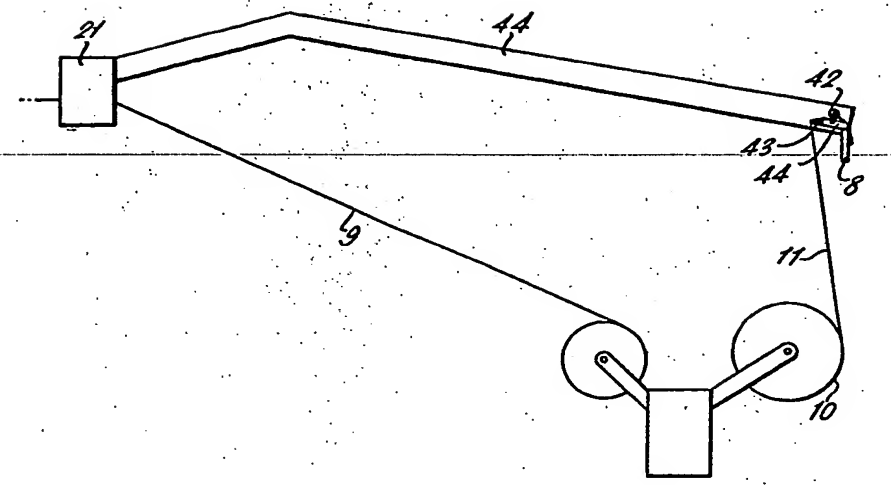
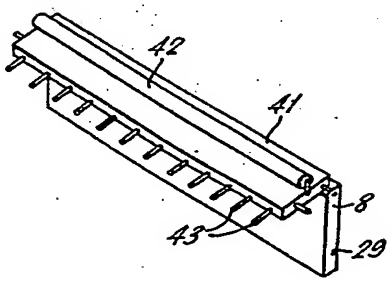


FIG. 18.



Record - 149

Titolo: **Plying paper webs for making corrugated cardboard_by applying adhesive to stationary web and pressing it against moving web**

P. Assignee: GUSTAFSON S (GUST-I)
INTERFIC ENGG LTD (INTE-N)

Patent Family:

Patent No	Kind	Date	Applic No	Kind	Date
BE 852029	A	19770905		(Basic)	
DE 2708644	A	19770915			
NL 7702264	A	19770906			
FR 2342848	A	19771104			
US 4172755	A	19791030			
GB 1569886	A	19800625			
IT 1080022	B	19850516			

Priority:	CC Number	Kind	Date
	GB 768538	A	19760303

Riassunto: *BE 852029_A / Two webs are plied together by e.g. advancing them both through two separated roller nips. PRef. one roll of the first nip is moveable so that the first web can be passed over it and held stationary while adhesive is applied. This first web is then pressed against the second web which is being advanced by rotation of the rollers of the second nip. The first web adheres to the second web and is advanced by it through the second nip so that they are pressed together. / The device is used for plying paper webs for feeding to a machine which makes corrugated cardboard. The device is cheap to manufacture and can be easily operated by unskilled operatives.*

Int. Classif.: B31F-000/00 / B32B-031/20 / B65H-019/18 / B65H-021/00 / D21H-001/04